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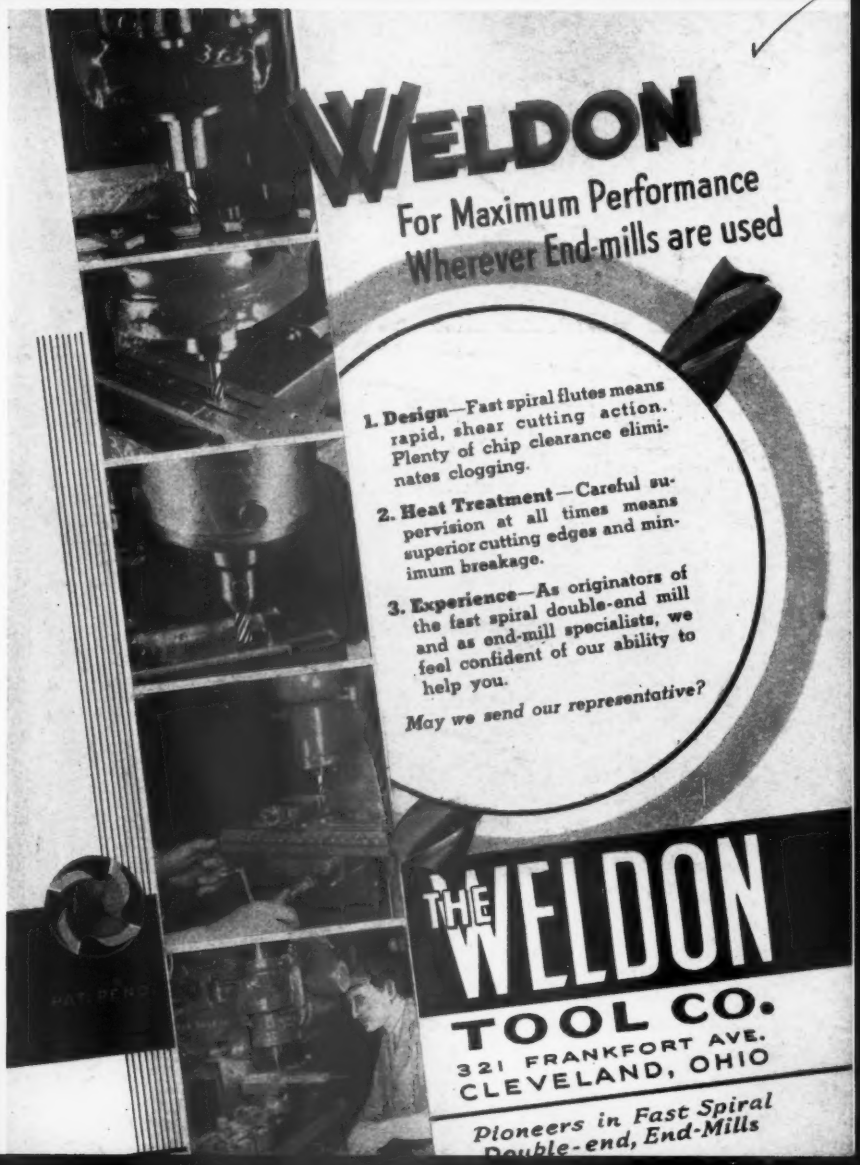
THE NATIONAL TOOL AND DIE JOURNAL

TOOLS, DIES, JIGS, FIXTURES, MOULDS, GAGES, MACHINES
Design and Engineering
PRECISION SPECIALTIES STAMPING and PARTS PRODUCTION
Official Publication
Special Tool, Die & Machine Shop Industry

UGUST,
1937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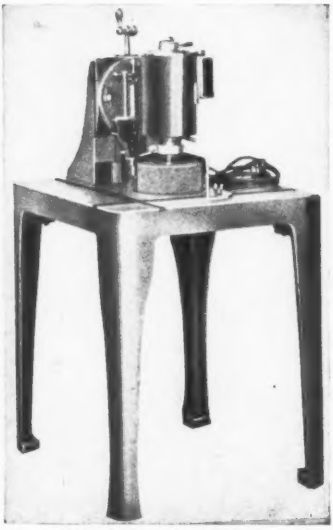

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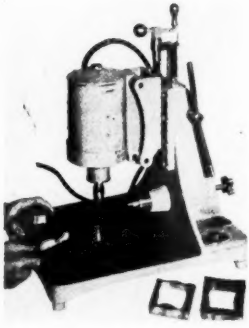

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Ye Editor's Notes

We think this August number is an interesting one. It features two outstanding articles: An informative description of Timken's new graphitic die steel by two authorities, G. A. Stumpf and F. R. Bonte, also a first-hand survey of "Business in Europe" made by L. A. Wilkie, well-known inventor and manufacturer who has recently returned after a five months' trip abroad.

Pages 14—31 are of particular interest to BUYERS of TDM Industry products. Here is a timely article by J. H. Lyons, President of the Northern Ohio Division of the Institute, which presents, from a cooperative standpoint, the unusual factors which enter into the buying of custom-built Tools, Dies and Machines. "The Story of Two Jigs" recounts an experience which is all too frequent and from which members of the TDM Institute are striving to save users of their products.

Several contract shops have taken advantage of this section of the book by calling attention to their facilities, and the usual TDM Industry Directory will also be found there.

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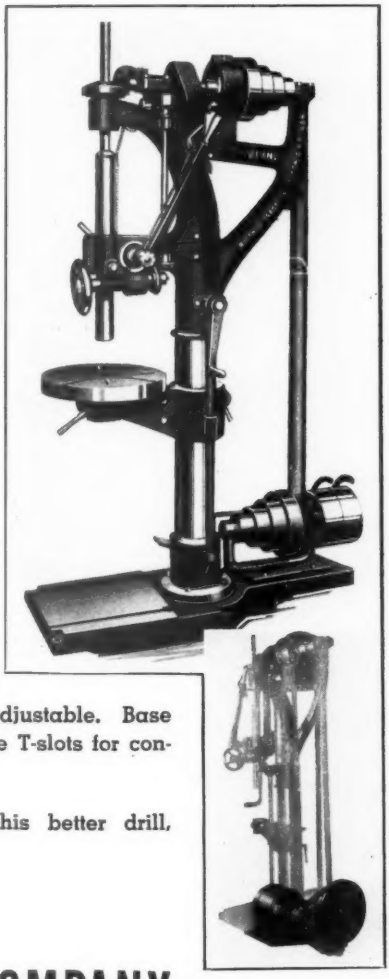

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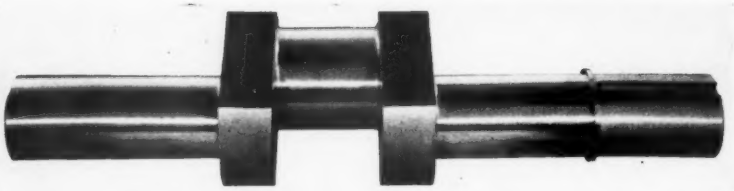

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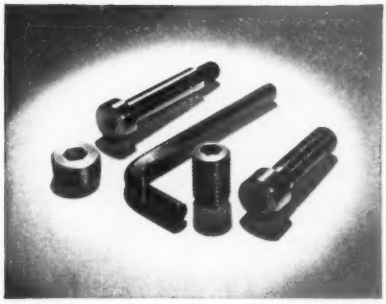

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Tool • Die • Machine **PROGRESS**

The National Tool and Die Journal

August, 1937 **Vol. 3, No. 5**

Graphitic Steel, Its Fabrication, Heat Treatment and Application to Dies and Punches

By G. A. STUMPF AND F. R. BONTE

Steel and Tube Division

The Timken Roller Bearing Company

For our April issue, F. R. Bonte wrote an exclusive article describing "The New Timken Graphitic Steel for Dies." Here is another intensely interesting description of this remarkable steel development, considerably augmented by facts and data gathered from its use during the intervening months.—The Editor.

THERE are many fields where a metal combining the free machining qualities, high resistance to wear and good frictional properties of cast iron with the uniformity, ease of hot or cold working, ready response to heat treatment, and good physical properties of steel, would be of value. This is particularly true in the die industry.

Graphitic steel apparently combines these qualities and both the laboratory and service tests indicate that it will meet a need that now exists in modern high speed heavy duty production. This new material, which is a high carbon steel in which a substantial part of the carbon is present in the form of free graphite when the steel is ready for machining, is now being produced commercially for both water and oil hardening applications in the die field by The Timken Roller Bearing Company.

As now produced, the basic analysis of this steel carries approximately 1.50% total carbon and approximately 1.00% silicon. It is an electric furnace product, made under rigid control. Ingot size and stripping temperature play an important part in the successful production of this material, for once an excessive amount of free graphite has been precipitated, heat treatment will not restore forgeability to the steel.

As rolled, but before preliminary heat treatment, graphitic steel is a hypereutectoid material composed of pearlite and free cementite with the possible appearance of finely divided free graphite. Ordinarily only approximately 20% of the total carbon will appear as free graphite in the steel in this condition, dispersed so finely throughout the steel that no pockets or definitely defined graphitic areas will be noticed.

The high silicon content of the steel renders the carbide phase unstable, allowing the cementite to be broken down into ferrite and free graphite. For most machining operations, graphitic steel is normalized and annealed. This reduces the combined carbon and precipitates part of the total carbon in the form of graphite, uniformly distributed in minute pockets throughout the steel. The pearlite typical of an annealed structure is spheroidized to the degree normally associated with good machining qualities. Experience indicates that this material machines practically as easily as gray cast iron.

Two types of graphitic steel are now being made. That used for water hardening applications is known as Graph-sil. For oil hardening applications, or where distortion must be held to an absolute minimum and where special toughness is required for the service, approximately 0.25% of molybdenum is added to the specification, this steel being called "Graph-mo." Preliminary and final heat treatments depend upon the application for which the steels are to be used.

Care must be exercised in the processing of graphitic steel to control graphitization, for once the graphitic pockets are established they are permanent unless forged together. The degree of graphitization can, however, be largely controlled by the annealing treatment. Consequently, material which is to be forged to shape is worked from the "as rolled" condition, where a high percentage of combined carbon exists, in which state it can be hot worked very satisfactorily if reasonable care is exercised in keeping the temperature of the piece between 1700° F. and 2000° F. A light annealing treatment must be applied to Graph-mo as it comes from the mill before it can be sawed, but this treatment is carefully controlled to avoid graphitization.

Material for machining, however, should be normalized and annealed to secure best results. Thus, billets of Graph-sil for forging into dies are shipped in the "as rolled" condition and Graph-mo billets are only softened enough to permit cold sawing. All stock which is to be machined to shape is shipped only after normalizing and annealing, regardless of whether it has been forged to shape or is still in the bar or billet form.

Heat Treatment

The graphite particles present in graphitic steel after normalizing or annealing are utilized in the final heat treating and hardening processes. When steel of this type is held at heat above the carbon change point, part of the graphite is absorbed, but the pockets remain the same. Quenching develops a martensitic structure, the material reacting in much the same manner as does a eutectoid tool steel.

Physical properties of graphitic steels are closely related to the microstructure developed in the material. This in turn depends on the heat treatment, which controls the amount of combined carbon. A typical set of values for both Graph-sil and Graph-mo is presented in Table I.

Although the exact heat treatment depends upon the service to which a die or punch is to be subjected, enough experience is now available to justify certain general rules. These, of course, are subject to modification to meet specific cases, but the following outline for the heat treatment of Graph-sil and Graph-mo dies and punches is based on practical experience over a considerable period of time and in a number of plants.

As a general rule, blanking and forming dies or punches made from Graph-sil, or water hardening graphitic steel, should be quenched in water or brine from 1550° F. and drawn at 300° F. The blanking punch shown in Fig. 1 is a typical example of the punches made in a wide range of sizes for blanking and forming Timken bearing cages from hot rolled and pickled strip steel. Punches of this nature have been used on material up to ⅜" thick with uniformly good results. The unit shown was heated to

Table I
Physical Properties of Graphitic Steel

Type	Treatment	Yield Point Lbs. Per Sq. In.	Ultimate Strength Lbs. Per Sq. In.	Elongation in 2"	Reduction of Area	Brinell Hardness
Graph-sil	Annealed	56,000	97,500	25.5%	47.5%	171
	Normalized from 1600° F.	87,500	163,750	11.5%	18.5%	302
	Quenched from 1500° F. into water and tempered at 900° F.	158,000	194,000	8.5%	18.0%	401
	Quenched from 1500° F. into water and tempered at 1100° F.	120,500	142,500	15.5%	29.6%	285
Graph-mo	Annealed	49,500	84,500	25.0%	40.1%	197
	Quenched from 1475° F. into oil and tempered at 900° F.	177,000	218,000	8.5%	14.0%	388
	Quenched from 1475° F. into oil and tempered at 1100° F.	136,000	164,000	13.0%	23.0%	302

1550° F., held at heat for 1 hour per inch of section and then quenched in brine maintained at approximately 80° F. It was then drawn at 300° F., giving a file hard surface of 63 Rockwell C.

Such a punch should be quenched to a depth just below the first undercut and held in the brine until it reaches a temperature of 300° to 400° F., after which it may be dropped in oil for the final cooling. The length of time such a punch should be held in the quenching bath depends, of course, upon the section, but any good hardener can gauge his quenching time by the rate at which the piece dries when raised out of the brine.

Experience shows that when working with graphitic steel the die or punch should be held at heat for at least one hour per inch of section before quenching and that the drawing operation should provide at least 4 hours at heat per inch of section. Time at heat is particularly important in both instances and any attempt to reduce the minimum here given has resulted in unsatisfactory results.

I.D. punches used in connection with the blanking punch just described should be treated in the same manner except that the hole should be plugged and the punch should be immersed in the brine just past the working surface. I.D. dies such as are used for shaping cages, brake drums, etc., can also be quenched in brine from 1550° F., transferred to oil and drawn at 300° F., developing a hardness of 62-63 Rockwell C. The larger the section, the more important it is to be sure that ample soaking time at heat is provided.

There are innumerable applications for blanking or perforating dies and punches where long life, sharp edges, wear resistant faces and freedom from chipping and spalling are essential. Likewise, these dies are commonly used in mass production operations and require frequent replacement, which raises the point of machinability, for the unit cost of the die, its life before and after re-dressing and the ease with which it can be touched up are important factors in the cost of the finished piece made from the die. Many such dies are in use in the Timken bearing factory. These were formerly made from various types of conventional steel, but since the development of graphitic steel they are all made of that material.

Ordinarily Graph-sil dies and punches are quenched in water or brine, but in the case of draw rings or blanking dies it is advisable to quench them in oil where the O.D. is less than 4", as they are likely to crack if made too hard. Quenching such a ring in oil from 1600° F. and drawing it at 300° F. for 4 hours per inch of section will develop a hardness of 58-60 Rockwell C. Where larger rings are concerned, the greater mass of metal permits such units to be quenched in water from 1550° F., cooled in oil and then drawn at 400° F., for a hardness of approximately 60 Rockwell C. Care should be exercised whenever water is used for quenching not to keep the ring in the tank too long, transferring it to the oil bath for cooling just as soon as the proper quenching action has been secured.

Graph-sil requires some care in quenching, but the tough non-warping Graph-mo has proved to be easy to handle, highly satisfactory for dies and

(Continued on page 32)

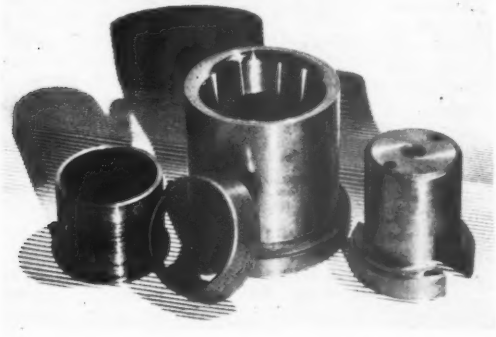

Fig. 1

A Typical Blanking Punch Assembly Made from Graph-sil for Blanking and Forming Bearing Cages from Hot Rolled and Pickled Strip Steel

Business in Europe

By L. A. WILKIE, President
Continental Machine Specialties, Inc.

Mr. Wilkie recently returned from a five-months' trip abroad. We asked him about "Business in Europe" and here he gives an interesting word-picture of it. Quite naturally he measures European progressiveness by the reception accorded his own company's product.—The Editor.

"ENGLAND has had five years of good prosperity, and a cycle between depression and prosperity lasts five years, therefore, the British boom is about over," so reasoned a shipboard acquaintance on the way over-seas to the Leipsig Fair, and a five month's trip to the British Isles and Continental Europe, recently completed by the writer. But after the interesting experiences of these months in Europe, one finds at least five reasons why this college professor's prediction is wrong.

1. England, playing its traditional role of maintaining a balance of power in Europe, was awakened to its inadequate military power through the Ethiopian affair. Since then, England has thoroughly "tooled-up" for war. Their program calls upon every fiber of industrial capacity. New machine tools by the thousands poured into the British Isles from the United States and Germany. Purchases were made on a lavish scale, and the British buyer purchased the best that the market affords. The newest, as well as the best, is what they wanted. They purchased not one but often several of one machine for each plant. The plant of Fisher & Ludlow in Birmingham, for example, is recognized for its slogan, "The finest tool room in England." Its methods are as advanced as those of any tool room in the United States and in line with this policy, the reception given Contour Sawing by this plant was most enthusiastic. Contour Sawing, in fact, is only being pioneered in Europe now and the interest aroused by the DOALL machine was gratifying. Fisher & Ludlow put in four DOALLS and have two or more units of each of many advanced units of equipment.

When deliveries on new machine tools slowed down, resourceful dealers imported hundreds of used American machine tools and rebuilt them, and this is still a thriving business.

2. The American effort to work out a reciprocal trade agreement broke down when the British felt that such an agreement might upset the rich inter-colonial trading arranged through their Ottawa Agreement. The 53 million people in the British Isles like the way trade is moving under that plan and intend to keep on selling their own automobiles and radios to their own prosperous colonies exclusively as they have for the past several years.

3. The United States Neutrality Bill, which aims to prevent shipment of goods to warring nations, creates a necessity for the British to amplify their efforts toward self-sufficiency. England feels that she must further build up her own steel mills and machine tool plants, and these are definitely growing in England today.

4. Aircraft production, to meet commercial and war needs, is exceedingly active under a broad expansion program. American manufacturing methods are closely followed in this industry and aircraft manufacturers in England were keenly interested in learning of the savings gained in the wide use of Contour Sawing and the DOALL machine in the United States. The machine was readily accepted by British Aircraft manufacturers as the versatile machine tool for the fabrication of aircraft parts.

5. England is so rooted to traditions, so fixed in class divisions, that the country is a strong fortress against political panaceas. There are stability and prosperity in England that should go together for a long time.

Germany is prosperous, but it is not a natural, healthy prosperity. Germany has adequate coal and iron, but is sadly lacking in other essential materials,

(Continued on page 46)

for greater ACCURACY and EFFICIENCY on Boring and Milling Machines . . .

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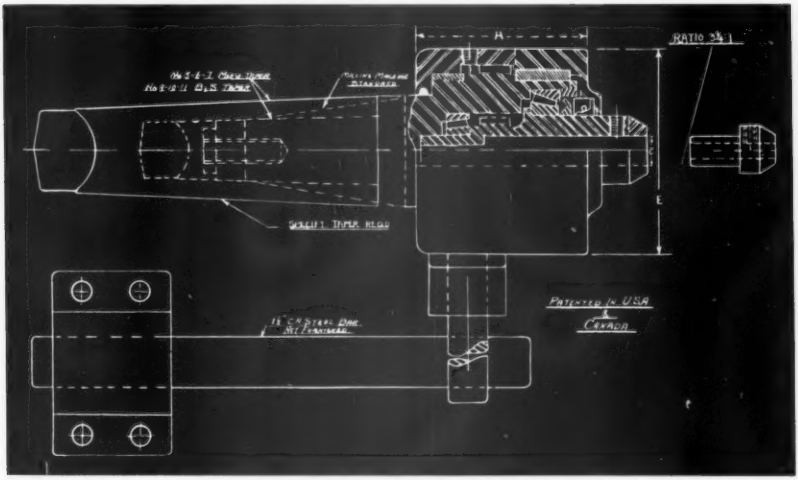

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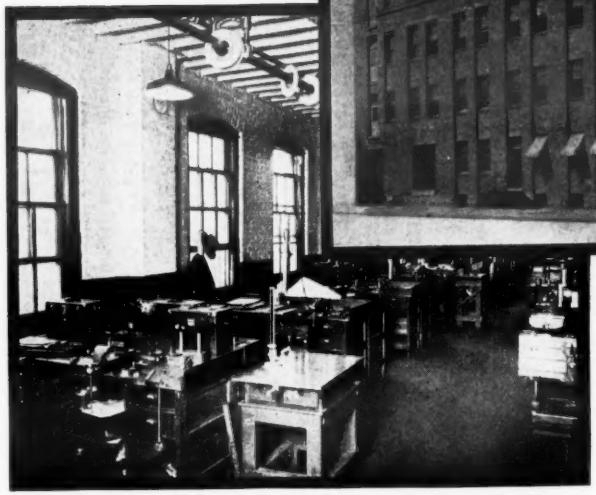

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On the contrary we DO stress a FAIR PRICE, leaving a reasonable profit, for CONSISTENTLY GOOD WORK.

Years of painstaking selection and training of supervisory personnel — together with a long established and most rigid inspection procedure before any job is shipped — practically eliminate the hazards of concealed faulty workmanship, substitution of inferior materials or inaccuracies beyond allowable tolerances.

Likewise — constant re-checking of the productive hours in our plant against available man and machine capacity guards against overloading — thus making for trustworthy promises on delivery time and protection for the buyers against getting them into the so-called "grease."

Many years experience in the TOOL AND DIE BUSINESS have taught us that — "GOOD TOOLS AT A FAIR PRICE" is a proper business policy. We solicit your business on this basis.

NOTE — There will appear on these pages, from time to time, various "Thoughts" pertinent to business in general and the Tool and Die Industry in particular. We invite comment.

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When you order or write about products described in TDM PROGRESS please mention the publication.

SPECIAL TOOL, DIE AND MACHINE SHOP INSTITUTE
A National Trade Association

The Buying of Special Tools, Dies and Machines Requires a Technique All Its Own

By JOSEPH H. LYONS
President Northern Ohio Division
Special Tool, Die and Machine Shop Institute

BUYING custom-built Tools, Dies and Machines is a different kind of buying from any other, and calls for a different technique. In contrast with the purchase of standard tools and similar items, the special tool or die is what may be called a one-time, single-purpose tool. Intended to perform a specific operation, usually on one part or product and no other, it has been meticulously thought out and carefully designed. It should be just as carefully built to unquestionably insure its own operating precision and the resultant accuracy of product.

Manufacturing executives, engineers and production officials, who have a thorough understanding of the result which is to be achieved, should always pass on to the buyer — the man responsible for the actual purchase — not only a blueprint with more or less complete specifications, but also such additional information as will assist him in determining what type of TDM shop he ought to choose and how long a time he should allow for the construction and delivery of an assuredly perfect tool.

Large manufacturing organizations frequently decide such important buying in conferences attended by all interested officials and department heads. A buyer handicapped by insufficient knowledge of a Special Tool, Die or Machine for which he receives a requisition, frequently fails to realize some of the most important factors which might contribute to obtaining the best built and most dependable tool — the one which, in the final analysis, will turn out more pieces accurately and assure the lowest ultimate product cost.

Among the many contract shops which comprise the Special Tool, Die and Machine Shop Industry may be found specialists in the building of every type of Special Tool, Die or Machine which may be thought of as necessary or desirable by members of the production industries. There are very few TDM shops which do not excel, because of the experience of the management or the individualized skill of workers or both, in the building of particular types of Tools, Dies or Machines. The buyer who would serve his own company best will always differentiate between shops. Aside from particular experience and specialized skill, the matter of suitable equipment and facilities is highly important. Thus, a builder of fine small tools and gages usually does not have the equipment to build a 20-ton drawing die and, vice versa, the builder of large dies is not generally equipped for small work unless, as in some instances, he maintains a separate department therefor. To build large dies requires extremely large capacity lathes, shapers, planers and boring mills, as well as the facilities for moving and handling large castings.

(Continued on page 20)

AN *Automatic* FLOWER POT MACHINE

which incorporates principles adaptable to the manufacture of other types of products . . . capacity up to 4000 per hr.

Established in 1893, we have had 44 successful years filled with experience which we believe qualify us to design and build all types of special production equipment, including:

SPECIAL MACHINES
DIES, TOOLS, JIGS and FIXTURES

We also do engineering and experimental work

Our facilities include the newest and most modern equipment for precision work.

The J. C. ULMER *Company*

1791 EAST 38th ST. *Established 1893* CLEVELAND, OHIO

We handle your tooling job from design to the finished product.

When you order or write about products described in TDM PROGRESS please mention the publication.

SPECIAL TOOL, DIE AND MACHINE SHOP INSTITUTE
A National Trade Association

A Story of Two Jigs

THIS is a true story. Perhaps it ought to be titled "No More Price-Buying." An old customer of ours sent us the prints to estimate two jigs. We had built similar ones for him and we knew what they cost. Our bid allowed for a normal profit. We lost the business. Someone else had quoted $100.00 less.

TIME marched on . . . Again we received prints and were invited to submit prices on two jigs. Our quotation took into consideration higher costs of material and labor. Again we figured a normal profit. We received the order.

EVENTUALLY the story of the two jigs which we did not build was unfolded to us. From the moment they were put into use, trouble began to develop with the customer's product. There were difficulties in assembly, complaints from other departments, rejections of the finished product, returns, waste, loss, and finally the "rumpus" reached the board of directors. Like a court of inquiry they sat and their decision was that there was to be no more buying of special tools, jigs or fixtures on a price basis.

WE have no way of knowing what loss was incurred as a result of the purchase of the two jigs which cost $100.00 less, but we will venture a guess that it was many times that.

* *

An authentic incident submitted by a member of the Special Tool, Die and Machine Shop Industry.

"An Institute Advertisement"

DESIGNERS AND BUILDERS OF

Tools - Dies - Special Machinery

OUR FACILITIES FOR LARGE WORK INCLUDE:

- **3 LUCAS PRECISION HORIZONTAL MILLS**
  — largest No. 42 oversize pattern.
- **No. 6 SWISS DRILL JIG BORER**
  — the largest capacity.
- **GRAY MAXI-SERVICE OPEN-SIDE PLANER**
  — table capacity 72" x 240".

May we estimate your work?

◆

The Bunell Method for Repairing and Reclaiming Dies and Punches Effects Savings as High as 90% of Original Cost

Restores worn forming and cutting edges without annealing . . . No drawing of temper . . . No rehardening . . . Let us put your discarded dies back into active, profitable service.

New edges compare favorably with high speed steel.

THE BUNELL MACHINE & TOOL CO.
1600 EAST 24th ST. CLEVELAND, OHIO
Phone PRospect 2681

When you order or write about products described in TDM PROGRESS please mention the publication.

SPECIAL TOOL, DIE AND MACHINE SHOP INSTITUTE
A National Trade Association

(Continued from page 16)

These are quite different from machine tools which assure a tolerance of ± .0001 inch. And, what is more, a shop which is required to turn out such fine work should be, and invariably is, equipped to accurately check to such tolerances.

The delivery of a Tool, a Die or a Jig, insufficiently checked, can be very costly to both buyer and builder. The buyer, therefore, should fortify himself with first-hand information about the shop with which he is figuring and under no circumstances should he overlook providing the most concise data to accompany a request for an estimate from a shop from which he expects such highly accurate work. On the other hand, no TDM shop ought to accept an order to build a Tool, a Die or a Machine which, for one reason or another, is not within the limits of which its organization and facilities are capable. To do so, and to fail, certainly involves the possibility of loss of prestige. There is usually sufficient business of each class to be had, therefore a TDM shop owner is unwise to step beyond until he is justified by his experience and facilities.

Well designed tools, properly made and intelligently bought, are the foundation for profitable manufacturing. An incorrectly designed tool, or a poorly built one, can interrupt a production cycle so seriously that it affects every phase of profitable production. The "Story of Two Jigs" on page 18 of this issue is a case in point.

This article has attempted to cover only a small part of the extremely important "technique" of buying. The suggestions it makes have emanated from members of the Tool·Die·Machine Industry who operate shops which have built many of the important special tools used in production industries throughout the years. Their purpose is to be informative and it is hoped that buyers everywhere, who have among their duties the difficult task of buying custom-built TDM products, will accept them in the spirit in which they are offered.

To sum up briefly, the suggestions we would make to buyers are:

1. Know the shops from which you ask estimates. Neither you nor they should take the chance of an improperly built Tool, Die or Machine.

2. Never put price before all other requirements when you place an order. An inordinately low estimate may mean the seller has misunderstood your requirements or has made a mistake in figuring. To take advantage of that situation rarely turns out satisfactorily to the buyer and, of course, it definitely entails a loss for the seller.

3. There are jobs which, because they are difficult to estimate, would be less costly for the buyer on a "time and material" basis. In such instances, buyers can readily satisfy themselves, beyond a shadow of a doubt, that there are in all parts of the country TDM shops whose operation is so orderly and integrity so positively beyond reproach that a buyer takes no chances whatever when he elects to place contracts on that basis. A system of checking and verifying the account can be readily established.

Tool Die Machine Contract Shops Detroit, Michigan

DAVIS TOOL & ENGINEERING COMPANY
6481 Epworth Blvd. TYler 46070
TOOLS and DIES
Special Machinery
Sheet Metal
Stampings and Assemblies

***ENTERPRISE MACHINE PARTS CORP.**
Jerome Ave. at McNichols Rd. E. LOngfellow 9643-4
Manufacturers of
PRODUCTION MACHINE REPAIR PARTS
Motor Drives, Gears, Worms, Tools, Fixtures
Machine Overhaul Specialists

THE INTERSTATE TOOL COMPANY
19636 Mitchell Ave. TOwnsend 84853
Manufacturers — Engineers
Dies, Jigs, Fixtures, Gauges
Special Machinery *Machine Work*

***KOESTLIN TOOL & DIE CORPORATION**
3605 Humboldt Ave. LAfayette 1490
Manufacturers
Sheet Metal Dies "Grindrite" Die Grinders

***MAJESTIC TOOL & MFG. COMPANY**
2948 Woodbridge St., East FItzroy 1011
Manufacturers
General line of Tool and Die Work, Tool Details, Parker High Speed Grinding Spindles

NORTHEASTERN ENGINEERING CO.
3125 E. Larned St. FItzroy 1275
Specialists in the Designing and Building of Progressive Dies
Dies—Tools—Special Machinery

***ROBBINS ENGINEERING COMPANY**
635 Mt. Elliott Ave. FItzroy 4740
Designers and Manufacturers
Tools, Dies, Jigs, Fixtures
Special Machinery and Experimental Work

ROYAL OAK TOOL & MACHINE CO.
621 E. Fourth St. ELmhurst 6590
Manufacturers of
Tools, Dies, Jigs, Fixtures
Special Machinery and Designing
Hook Self-Centering Cylinder Reamers

STAR TOOL & DIE WORKS
2522-24th St. LAfayette 1716
BUILDERS of DIES
Facilities for the Largest
MANUFACTURERS
of STAMPINGS

***VINCO TOOL COMPANY**
7350 Central Ave. EUclid 9200
PRECISION GAUGES and TOOLS
Spline Gauge and Master Gear Specialists

*See larger display advertisement also.

Streamline YOUR ADVERTISING

A copy of Tool·Die·Machine PROGRESS is mailed each month directly to each individual who has reason to be interested in it. There need be no passing around of the book—no tearing out of important articles and advertisements—every man keeps his.

Two groups receive TDM PROGRESS.

1. BUILDERS of Special Tools, Dies and Machines—both the "contract" shop and the "inside" shop.
2. USERS of Special Tools, Dies and Machines—the production industries.

If you have something to sell either or both groups, there is no more DIRECT line to the man who buys and uses it. The way is open—no resistance—it's the Stream-line.

Please write for rates.

Tool·Die·Machine PROGRESS 215 Fairmount-Cedar Building CLEVELAND, OHIO

When you order or write about products described in TDM PROGRESS please mention the publication.

Tool Die Machine Contract Shops
Cleveland, Ohio

BARTH STAMPING & MACH. WORKS
W. 34 & DENISON SHa. 1857
DIES—TOOLS—JIGS—MOLDS
GLENN A. BARTH THOM. A. BARTH
J. A. BARTH J. J. BARTH

***THE BUNELL MACHINE & TOOL CO.**
1600 East 24th St. PRospect 2681
JIGS—FIXTURES—GAGES—MODELS
Blanking, Forming, Drawing, Piercing
Trimming, Bending and Coining Dies
Special Tools and Machinery

CLEVELAND UNIVERSAL JIG COMPANY
13404 St. Clair Ave. MUlberry 3322
Designers and Builders
Jigs & Fixtures Special Machines
Production Engineering
COMPLETE PLANT ROUTING and TOOLING

THE DENNING MANUFACTURING COMPANY
1775-81 East 87th St. CEdar 0801
Designers and Builders
HIGH GRADE DIES

HAHN MANUFACTURING COMPANY
5332 Hamilton Ave. ENdicott 2205
Modern equipped shop for building of
MEDIUM AND LARGE
DIES, TOOLS, SPECIAL MACHINERY
Equipment includes:
3" and 5" spindle Horizontal Boring Mills
Large planers Vertical Mill

THE INDUSTRIAL MACHINE CO.
1436 East 47th Street Founded in 1903
Builders of Special Machinery
GENERAL MACHINE WORK

***LYONS MACHINE COMPANY**
5601 Tillman Ave. WOodbine 2440-2441
Manufacturers Special Machinery
Tools, Jigs, Fixtures Tungsten Carbide Tools
SWISS JIG BORING

***THE McKINNEY TOOL & MFG. CO.**
1688 Arabella Rd. KEnmore 1681
Roller Die Forming Machines
Automatic Saw and Shear Cut-off Machines
Special Machinery—Dies, Jigs and Fixtures

MODERN TOOL & DIE CO.
P. O. Box 2741
West Park Branch CLearwater 6149
DESIGNERS AND BUILDERS
Tools & Dies *Special Machinery*
STAMPINGS

***OHIO TOOL COMPANY**
3160 West 106th St. CLearwater 3200
Designers and Builders
SHEET METAL DIES, TOOLS, SPECIAL MACHINERY, DIE CASTING DIES, RUBBER MOULDS
•
Modern Facilities
150-Man Shop

THE PARAMOUNT TOOL CO.
1392-98 East 43rd St. ENdicott 2220
JIGS, FIXTURES, DIES
Experimental Work

The PHOENIX ICE MACHINE COMPANY
2711 Church Ave. CHerry 1048
72" Vertical
BORING MILL WORK
Let us figure

A. P. SCHRANER & COMPANY
3338 Payne Ave. HEnderson 8644
EXTERNAL CYLINDRICAL
LAPPING MACHINES
Special Machinery
TOOLS, DIES, JIGS, FIXTURES

***THE SOMMER & ADAMS CO.**
18511 Euclid Ave. KEnmore 0810-0811
DESIGNERS AND BUILDERS
Special Machinery
TOOLS, JIGS and FIXTURES

*See larger display advertisement also.

When you order or write about products described in TDM PROGRESS please mention the publication.

Tool Die Machine Contract Shops
Cleveland, Ohio

***STAR MACHINE & TOOL CO.**
Established 1903
9320 Woodland Ave. GArfield 2060
DIES - JIGS - FIXTURES
Special Machines
JIG BORING with
Pratt & Whitney Precision Equipment
NEW OPENSIDE PLANER EQUIPMENT
12 ft. x 48" Capacity

TOOLS & GAGES, Inc.
3106 East 63d St. MIchigan 7230
"Let us be your tool room."
DESIGNERS AND BUILDERS
Tools, Gages, Dies, Jigs, Fixtures
Special Machinery
SWISS JIG BORING
DIE CASTING DIES

***THE J. C. ULMER COMPANY**
1791 East 38th St. HEnderson 4601
Tools, Dies, Jigs, Fixtures
Special Machinery Designing and Building
Experimental, Model, Punch Press and
Screw Machine Work

THE VARIETY MACHINE & STAMPING COMPANY
12695 Elmwood Ave. LAkewood 8433
DESIGNERS AND MANUFACTURERS
DIES
METAL STAMPINGS
We are equipped to make dies and stampings
in production up to 250 tons capacity

Dayton, Ohio

***THE INTERNATIONAL TOOL CO.**
434-438 East First St.
Manufacturers and Engineers
Dies, Jigs, Fixtures, Gages
Special Machinery, Machine Work, Designing

Hamilton, Ohio

***THE HAMILTON TOOL COMPANY**
220-222 North B Street
Designers and Builders of
Tools, Dies, Jigs, Fixtures, Special Mach'y
The Hamilton Portable Elevating Table

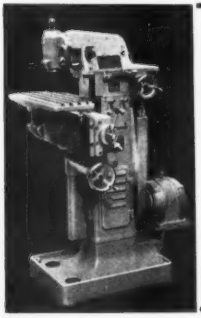
*See larger display advertisement also.

THE GEO. H. PORTER STEEL TREATING CO.

Tool Work Our Specialty

- *Heat Treating*
- *Annealing*
- *Carburizing*
- *Case Hardening*

1225 Marquette St. Tel. HEnderson 6601 Cleveland, Ohio
Write or phone for our copyrighted Hardness Conversion Chart

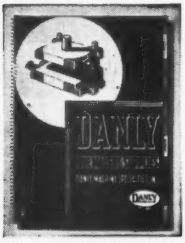


The Deckel FP1 . . .
UNIVERSAL TOOL ROOM MILLER
MILLS : : : BORES : : : REAMS
SLOTS : : : DRILLS : : : SHAPES
at any angle—Horizontal and Vertical
Write for modern milling machine booklet.
H. P. Preis Engraving Machine Co. 159 Sum it St. Newark, N. J.

When you order or write about products described in TDM PROGRESS please mention the publication.

DANLY PRECISION DIE SETS

SAVE YOU MONEY—HERE'S WHY:



The Danly Catalog makes it easy to select the proper die set for the job at hand. Ask for your copy.

● True, you pay a little more for a Danly Precision Die Set because the guide posts and bushings are perfectly fitted to within ± 1/10,000". That's what gives you the absolute accuracy of die movement that means perfectly made parts. It's one of the reasons why Danly Precision Die Sets can operate at a higher rate of speed—produce more parts before regrinding—protect the dies, as ordinary sets can't. Try a Danly Precision Die Set next time and prove to yourself the difference in long-time economy.

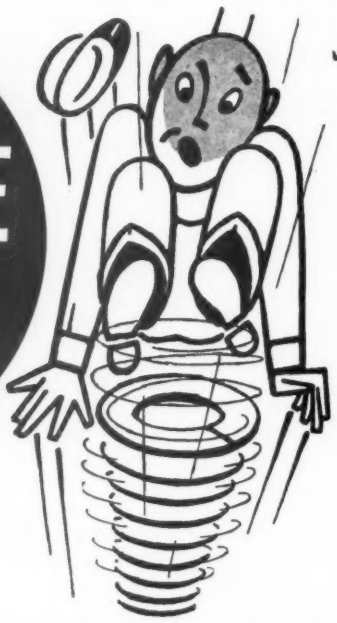
DANLY MACHINE SPECIALTIES, Inc., 2121 S. 52nd Ave., Chicago, Ill.

Long Island City, N. Y., 36-12 34th Street ● Rochester, N. Y., 16 Commercial Street
Dayton, Ohio, 990 E. Monument Avenue ● Cleveland, Ohio, 1745 Rockwell Avenue
Detroit, Michigan, 1549 Temple Avenue ● Philadelphia, Pa., 3913 N. Broad Street
Milwaukee, Wisc., 513 E. Buffalo Street

DANLY PRECISION DIE SETS

When you order or write about products described in TDM PROGRESS please mention the publication.

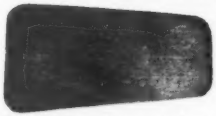
BUY PRESSURE NOT JUST STEEL!



You'll get plenty of kick out of these new Danly flat rounded springs—they're new and entirely different—livelier—stronger—longer lasting! They're engineered to combine a maximum flexibility with carrying capacity and compression.

DANLY FLAT ROUNDED DIE SPRINGS

● The reason they're better lies in the fact that they are made of a special analysis keystone wire which, in destruction tests covering three years, showed the highest fatigue life ever known in spring steel. The keystone wire when coiled, takes a rectangular cross-section to give it equal strength on both inside and outside spring diameters—greater carrying capacity for hole size. It means longer life and fewer spring replacements for you. *The new Danly Spring Chart describes it more fully. Send for your copy today.*



The special analysis steel wire is drawn in this keystone shape.

When coiled, it takes this shape to give it greater strength, longer life. When you start with ordinary flat wire the exact reverse is true.

DANLY MACHINE SPECIALTIES, Inc., 2121 S. 52nd Ave., Chicago, Ill.

Long Island City, N. Y., 36-12 34th Street ● Rochester, N. Y., 16 Commercial Street
Dayton, Ohio, 990 E. Monument Avenue ● Cleveland, Ohio, 1745 Rockwell Avenue
Detroit, Michigan. 1549 Temple Avenue ● Philadelphia, Pa., 3913 N. Broad Street
Milwaukee, Wisc., 513 E. Buffalo Street

DANLY DIE MAKERS' SUPPLIES

When you order or write about products described in TDM PROGRESS please mention the publication.

SPECIAL TOOL, DIE AND MACHINE SHOP INSTITUTE
A National Trade Association

Tool·Die·Machine PROGRESS Gets Involved Internationally

WE seem to be regularly getting into international affairs. First, it was an order from England received by one of our advertisers; then an inquiry from Turkey for a special machine, similar to one described in a Tool·Die·Machine PROGRESS advertisement; next, from Czechoslovakia, the description of a metal working operation and a request for information about a machine to do it; and now comes a three-cornered discussion between America, Germany and Sweden, all because of a statement made in Tool·Die·Machine PROGRESS.

Here is how it all happened. In the July issue of Tool·Die·Machine PROGRESS we reproduced portions of the Third Calvin W. Rice Memorial Lecture which Hilding Tornebohm, of A.B. Svenska Kullagerfabriken, Goteborg, Sweden, which we know as SKF, delivered before a meeting of The American Society of Mechanical Engineers. A few days after the issue had been mailed we received from the George Scherr Company of New York City an interesting letter discussing their advertising and containing also the following paragraph:

> "The writer has also read with much interest the leading article in the July number on 'Modern Tolerance Requirements and Their Scientific Determination.' One statment in the article in our opinion is not quite accurate, namely: 'The reason for this is that the development of measuring equipment such as plug gauges, snap gauges, micrometers and bore gauges, which are generally used in industry today, has not improved to any great extent over the past 25 years, although, ...' This would ignore entirely the radically new developments in Zeiss Indicating Snap Gauges, and Indicating Plug Gauges, as per enclosed catalog FE103, also in the Indicating Micrometer, by Zeiss. We have already asked the factory in Germany to bring these tools to the attention of the author, who we note is connected with SKF in Sweden."

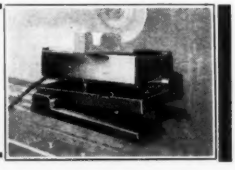
Now the George Scherr Company is the exclusive representative in the United States of Carl Zeiss of Jena, Germany, manufacturers of the well-known line of precision gauging and measuring instruments, the high quality of which is acknowledged wherever precision instruments are used. And, what is more, we find it to be perfectly true that Zeiss is responsible for "radically new developments" in the field of gauging and measuring, therefore, we feel we would be doing an injustice to the American representative of this firm if we did not provide the opportunity and make available the space for this to be published.

For which side engineers and production executives will take as to the progress which has been made in the line of developing better gauging and measuring instruments, we can hardly be responsible and this is also applicable to Mr. Tornebohm's statement; he expressed it as his opinion and we have printed it as such.

In spite of all this, however, we cannot help but feel pretty good over the way events have shaped up . . . George Scherr, American, reads it in Tool·Die·Machine PROGRESS, writes Carl Zeiss, German, who in turn, writes or calls on A.B. Svenska Kullagerfabriken, Goteborg, Sweden. Result—perhaps Zeiss will sell SKF some of those new Indicating Snap and Plug Gauges and Micrometers. Who knows?

Saves Hours of Set-up Time
•
Accurate to Precision Limits

The MAGNA-SINE
A Magnetic Sine Table Adjustable to ANY DESIRED GRINDING POSITION
ROBBINS ENGINEERING CO.
637 Mt. Elliott Ave. Detroit, Mich.



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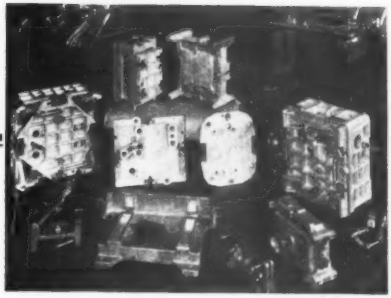


Skill . . . FOR SALE

The member shops of the
SPECIAL TOOL, DIE & MACHINE SHOP INDUSTRY
are becoming ever more important to other industries. Literally, they have "Skill For Sale." Their activities are greatly varied, their products and services many, but SKILL is a preeminent requirement. For every job, workers must possess a high degree of skill, while management contributes the experience which comes only from actual contact with many industries' problems. Together they assure users of the many kinds of custom-built Tools, Dies, Jigs, Fixtures, Moulds, Gages, Machines and other Precision Specialties and Products, manufactured in the TDM Shops of the Nation, a degree of service which is well-nigh invaluable. To members of the production industries, we say: *Always* call in members of the TDM Industry when you have a tooling problem. Their experience, the skill of their workers, the facilities of their shops cannot help but be highly beneficial to you.

SPECIAL TOOL, DIE & MACHINE SHOP INSTITUTE
A NATIONAL TRADE ASSOCIATION
This advertisement is one of a series intended to describe the TDM Industry.

When you order or write about products described in TDM PROGRESS please mention the publication.

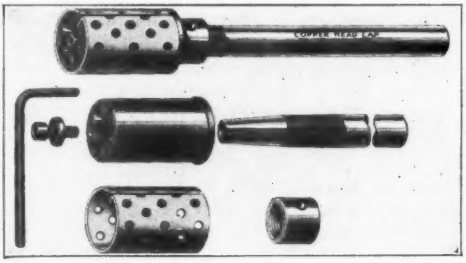
Copper Head Laps Are Essential Tools

LAPPING is a highly essential finishing operation in tool, gage and die making, in the building of precision machinery, in the production of interchangeable metal parts, and in the many similar highly specialized activities of TDM shops and the tool rooms of the production industries.

Commercially made laps are a comparatively recent development. Previously, tool makers and other crafts requiring them made their own to fulfill the requirements of the job on hand.

The development of the Copper Head Lap and its manufacture in all standard sizes has provided tool rooms and die shops with dependable laps ready to use when needed, and at prices which probably represent a cost lower than they can be produced for, by the tool shop.

The Boyar Schultz Corporation of Chicago now owns the patents on Copper Head Laps, having recently completed purchase from the Groetchen Tool & Manufacturing Company. Manufacturing and selling rights are also included.



Copper Head Laps are of several types, the newest development being the expansion type. A steel shank, tapered at one end, has a keyway which engages the key of the lap body. A threaded hole on the end of the shank fits a hardened socket head screw on which there is a locking collar which can be set to limit the amount of expansion as desired, also to force the lap body off the taper shank.

The lap body itself is a die casting of special composition, the metal possessing great resiliency. The taper of the body hole corresponds to that on the shank, and with a shoulder holding the locking washer the shank is drawn into the lap body uniformly expanding it. The range extends several thousandths of an inch below and above the standard or nominal size. A perforated copper lapping sleeve follows the expansion and contraction of the lap body, these perforations forming pockets for retaining the abrasive which thus assures continual charging of the copper lapping service.

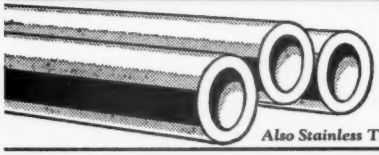
The rotation of the lap, combined with a reciprocal up and down motion, quickly removes scale and material and leaves a perfectly cylindrical hole with excellent finish. The entire wear of the Copper Head Lap is taken up by the replaceable copper sleeve. This sleeve can be removed quickly, and a new sleeve, already sized perfectly, substituted therefor.

These copper replacement sleeves are inexpensive and tend to reduce lapping costs by prolonging the usability of the Lap Assembly. Copper Head Laps are sold singly and in sets and there are special types for die and tool makers.

Members of the TDM Industry and readers of Tool·Die·Machine PROGRESS are invited to send for any standard size Copper Head Lap from ⅛" to 2" diameter for a 10 day trial without cost.

Write to Boyar-Schultz Corporation, 2114 Walnut Street, Chicago, Illinois.

OIL HARDENING TOOL STEEL TUBING



Substantially reduces labor costs by eliminating the expensive procedure of drilling from the solid.

BISCO TOOL STEEL TUBING is a fine grade tool steel in tubular form available in sizes up to 14" diameter and 2" wall thickness; other sizes to your specification.

THE BISSETT STEEL COMPANY

947 East 67th Street Cleveland, Ohio

Also Stainless Tubes, Mechanical Tubes, Aircraft Tubes, Pressure Tubes

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New Chesterman Height Gauge of Unusual Interest to Tool, Jig and Fixture Builders

HEIGHT gauges have been used for many years by tool makers, machinists, engineers and layout men. They have been largely the conventional types whose limitations have frequently made it necessary to resort to other types of measuring instruments and methods.

The extreme precision which is practiced today in the production industries calls for a much higher standard of accuracy than ever before in the production of the Tools, Jigs, Fixtures and Machines which make possible this production. It is with this in mind that the manufacturers of the Chesterman Height Gauge, James Chesterman & Co., Ltd., the century old tool makers of Sheffield, England, have so carefully developed this measuring instrument in an effort to simplify and expedite measuring operations and at the same time positively assure the accuracy which is so essential in modern industry.

Among the features which make the newest model of the Chesterman Height Gauge unusually out-standing are its sliding head whose design is distinctly different and which may be moved throughout its entire range by a full-length large-diameter screw in the rear of the beam. The engaging nut is split and is disengaged for quick approximate setting of the head, by simply pressing two lugs on the sides and sliding the head along the beam.

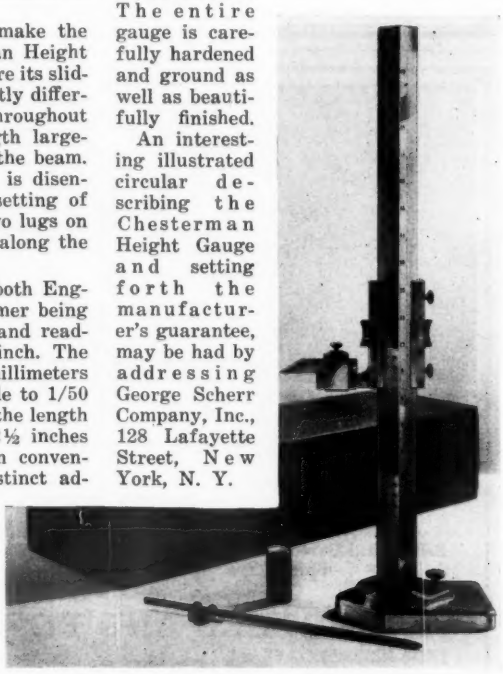
The gauge is provided with both English and Metric Scales, the former being graduated in 1/20 of an inch and readable with the vernier to 1/1000 inch. The Metric Scale is graduated in millimeters and with the vernier is readable to 1/50 mm. An outstanding feature is the length of the vernier which is about 2½ inches long, easily twice that used on conventional height gauges. The distinct advantage which this provides is readily apparent to all who have occasion to use a height gauge. A master gauge block is provided with each gauge to test the accuracy of setting.

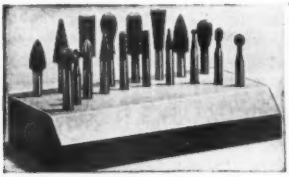
Another decided advantage of the new model Chesterman Height Gauge is the location of the fine adjustable screw in the base. A downward pressure on this screw, instead of causing the gauge to tilt or otherwise move, holds it even more firmly to the surface plate. Tool makers will particularly appreciate this as a feature which can save both much time and effort.

The gauge's triangular scale beam makes for greater strength and rigidity and by preventing sway and vibration, it becomes a real advantage in the lay-out and checking of large jigs, fixtures and machine parts. Precision indicators even when used in the extreme extended position are said to be firm and steady.

The gauge has a large base heavy enough to prevent tilting or toppling over, the bottom contact surface being lapped optically flat to assure a firm foundation. The entire gauge is carefully hardened and ground as well as beautifully finished.

An interesting illustrated circular describing the Chesterman Height Gauge and setting forth the manufacturer's guarantee, may be had by addressing George Scherr Company, Inc., 128 Lafayette Street, New York, N. Y.





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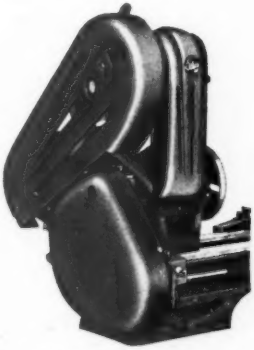
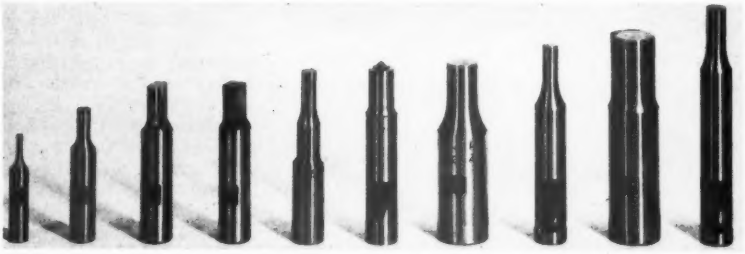


BELT Shields for Atlas 9 and 10 Series Lathes with self-contained countershafts are now available according to announcement of the manufacturer. The entire transmission of any recent Atlas lathe is fully enclosed with these belt guards installed. They are aluminum castings with pin-hinges for quick raising and speed changes. The guards need not be removed for belt changes. The left guard covers the motor-to-countershaft belt and has a special inner guard for the pulley on the countershaft while the right guard covers the belt to the lathe spindle. The entire assembly is easily installed and provides a high degree of safety for the lathe operator.

Detailed information may be had from Atlas Press Company, Kalamazoo, Michigan.



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Graphitic Steel

(Continued from page 11)

punches. The blanking punch shown in Fig. 2 for example, was made from Graph-mo, quenched in circulating oil from 1475° F. and then drawn at 300° F. This treatment produced a file hard punch, the working face being 63-64 Rockwell C. With this non-warping steel it is seldom necessary to use special quenching fixtures, drop quenching being ordinarily all that is needed.

Sizing dies such as the one shown in Fig. 3 operate under high pressure and it is essential that the working surface be very hard while the body of the die is tough. Consequently, they should be quenched on a fixture, any bolt holes being plugged with asbestos and the sides protected. For small dies best results will be secured by concentrating the flow of coolant through the hole in the die. On large dies it is necessary to quench the whole die under a fountain. In either case the working surface should be file hard, tests showing that by quenching from 1550° F. into brine and drawing at 300° F. a hardness of 63 Rockwell C is developed. Soaking and drawing times should be based on the same schedule as previously listed.

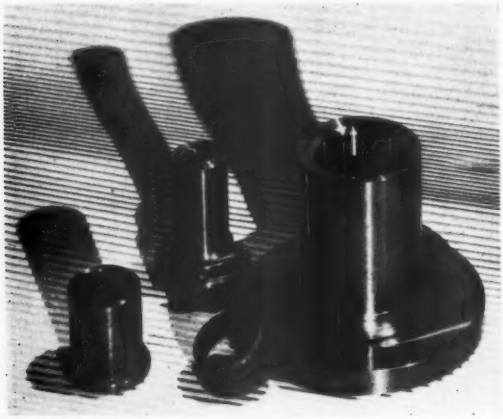

Fig. 2. A Graph-mo Blanking Punch

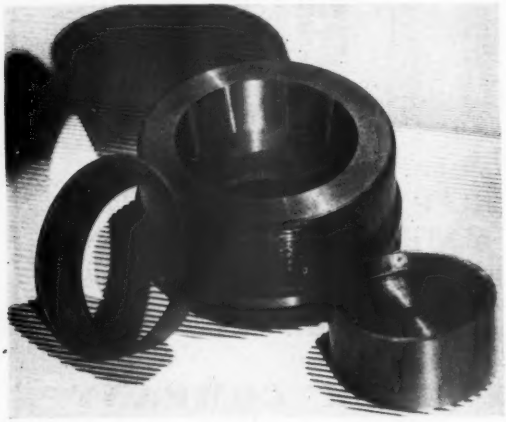

Fig. 3. A Sizing Die Whose Surface Must be Very Hard and Body Tough

Perforating units used in multiple dies at the Timken plant for perforating the pockets in bearing cages are made of Graph-mo. These punches, which are used on strip steel up to $\frac{1}{8}$" thick, are given constant high speed service and were formerly made from conventional steel. The graphitic steel parts, after having been machined and ground to size and shape, are heated to 1475° F., held at heat for one hour per inch of section and quenched in circulating oil. Following the quench they are drawn at 700° F., holding them at heat for 4 hours per inch of section to assure uniformity of structure throughout. This treatment develops a surface hardness of 52-54 Rockwell C, which, while not file hard, has been found to give the most satisfactory results in service. Fig. 4 shows a perforating die used for making cages for the standard type Timken Bearings. The same treatment is used on I.D. dies.

Multiple punches such as will be seen in Fig. 5 are used in the Timken bearing factory for coining or "winging" the edges of cage pockets to conform to the contour of the rolls. As cages are made from strip steel up to $\frac{1}{8}$" thick, the die

wings and punches must be file hard and withstand both heavy pressure and shock, retaining their sharp edges and smooth faces during long production runs. Experience shows that for dies and punches subject to service of this nature the oil hardening Graph-mo gives excellent results when quenched from 1475° F. and drawn at 300° F. to a hardness of 63-64 Rockwell C. At least 4 hours at heat should be allowed per inch of section in drawing Graph-mo coining dies and punches.

The center pins used for operating the multiple perforating or winging (coining) punches do not need to be as hard as the punches, but must be extremely tough and wear resistant, as any inequality on the operating face will affect the coined surface. Many times the life of conventional steel center pins has been secured in the Timken plant by using Graph-mo for these parts. High fatigue strength is secured with good wear resistance by quenching pins of this nature from 1450° F. in oil and drawing them for 4 hours per inch of section at 600° F., which develops a hardness of 55-57 Rockwell C.

Closure dies may be made from either Graph-sil or Graph-mo, depending upon the service desired. When Graph-sil is used, the heat treatment is the same as that given for sizing dies. If Graph-mo is used, the steel is quenched from 1475° F. and drawn at 300° F. for 4 hours per inch of section.

Heavy duty coining punches require a high drawing temperature, for toughness and freedom from chipping are essential. Graph-sil has been used at the Timken plant for coining ⅜" strip (S.A.E. 1015 steel) with very satisfactory results. The largest punch used to date in the Timken plant for this purpose has an outside diameter of 2½". It was held at 1550° F. for two hours, quenched in brine at 80° F. to a depth of 1½", cooled in oil and then drawn at 650° F. for 8 hours, showing a hardness

(Continued on page 34)

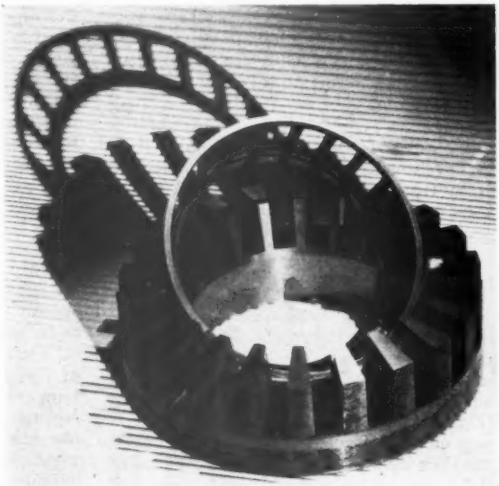

Fig. 4. A Perforating Die for Making Timken Tapered Roller Bearing Cages

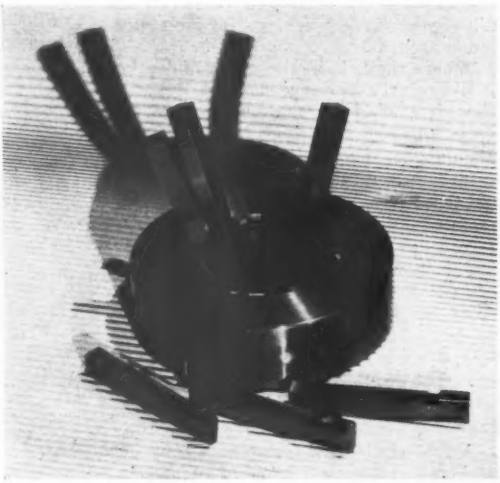

Fig. 5. Multiple Punch and Die Assembly for "Winging" Cage Pockets

Graphitic Steel

(Continued from page 33)

on the working face of 55 Rockwell C.

Rolls for use on forming machines for shaping bicycle rims, truck wheel rims, moldings, pulleys and other irregular shapes from strip steel have been successfully made from Graph-sil. These rolls should be quenched in brine from 1550° F., transferred to oil for cooling and drawn at 300° F., developing a hardness of 63-64 Rockwell C. Experience to date indicates that rolls of this character, such as are shown in Fig. 6, will last from two to four times as long as the steel rolls formerly used and that they show a remarkable freedom from pick-up.

Forming dies have been made from this same material in a wide range of sizes, the largest to date having been 30" in outside diameter. The smooth, wear resistance surface, free from pick-up or scoring, which features graphitic steel makes it particularly suitable for dies of this class. Successful applications are now on record where such dies have been used for forming both hot and cold rolled strip steel, aluminum, brass, copper and bronze and certain small parts made of stainless steel. As graphitic steel responds readily to selecting quenching, fixtures and plugs may be used to good advantage in quenching forming dies made from it.

Where the hole in the die is under ¾" in diameter, experience shows that it should be quenched from 1500° F. Larger dies should be quenched from 1550° F., all sizes being quenched in brine at approximately 80° F. and transferred to oil for cooling. Tests show that a hardness of 63 Rockwell C results from such drawing these parts at 300° F. and service records show remarkably long runs before these dies need either polishing or regrinding.

A typical die used for spinning fan pulleys out of strip steel is also shown in Fig. 6 together with a sample of the product. Here the die is finished machined, including threading the holes, before hardening, which makes it essential that a non-warping steel be used. The user reports substantial economies in the cost of making dies of this nature and double or treble the life before re-dressing the faces since he started using Graph-mo. For dies of this character, the heat treatment consists of quenching in circulating oil from 1475° F. and drawing at 300° F., allowing a soaking period of at least 4 hours per inch of section. This treatment develops a hardness of 62-64 Rockwell C, as is also the case in the coining dies and punches previously described.

Cold header dies present many problems to die manufacturers and users. Graph-sil has been used successfully for making dies for rivets, cold formed from S.A.E. 3120 steel rods, up to ⅝" in diameter. These dies are quenched in water on a fountain from 1450° F., cooled in oil and drawn at 525° F. to a hardness of 55-57 Rockwell C being held at that temperature for four hours per inch of section. In making dies of this nature the quenching water should be directed through the hole or into the pocket, the outside of the die being protected when necessary. The hardness developed depends on the drawing temperature, increasing as the drawing temperature is reduced.

File hard faces can be secured on Graph-sil forming dies and punches such

(Continued on page 36)

Fig. 6. Forming Rolls and Die for Making Fan Pulleys from Strip Steel

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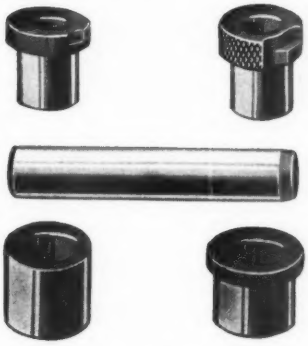

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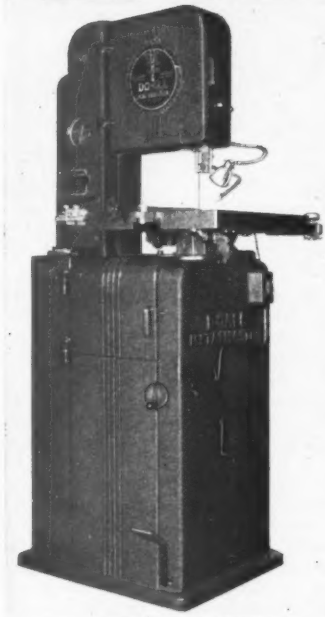

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Graphitic Steel

(Continued from page 34)

as are used for flaring tube ends by quenching them from 1600° F. in oil and drawing them at 300° F.

Twist guide rolls in a continuous bar mill are subject to severe service combining shock with intermittent high temperature and water sprays. A test installation using Graph-mo rolls has already given several times the life formerly expected and apparently will prove highly satisfactory. The new rolls do not crack, chip or spall and no heat checking has been noticed. The Graph-mo rolls were machined to shape after having received the customary graphitizing treatment of normalizing and annealing and then given a heat treatment consisting of normalizing in air from 1600° F., being held at heat for one hour per inch of section. No drawing was done, and a hardness of 280 Brinell was developed on the working face.

Graphitic steel was first tested in the Timken plant, being tried out on a cage drawing die, the press operating at 90 strokes per minute. This operation is one of the most severe in the plant and is used for testing any new steel stock. However, the initial run with a Graph-sil die turned out over 200,000 pieces without showing a single scratch, where formerly the longest run that had been made with a conventional die was 10,000 pieces and then it was necessary to grind off $\frac{1}{32}$" from the inner face of the die to remove scratches. The die shown on the left in Fig. 7 shows what happened to a conventional steel die after a run of 10,000 pieces, while the graphitic steel die on the right was free from scratches or scoring after turning out 309,000 pieces.

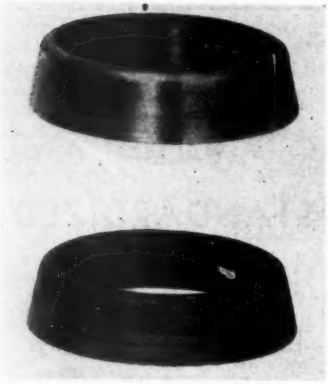

Fig. 8
Products Made by Two Dies Shown in Fig. 7. Upper from Graphitic Steel Die, Lower from Conventional Steel Die

Fig. 8 shows the differences in appearance of the product from these two dies.

This success led to other applications and today practically every die used in cage manufacture at the Timken plant is made of graphitic steel. Both the water and oil hardening types of this new steel machine easily, records showing that machining time for die and punch manufacture is reduced from 30% to 50% as compared to the die and tool steels formerly used. This free cutting quality applies to grinding operations as well as to lathe work.

Apparently the long life of graphitic steel dies and punches, as well as the smooth finish and high quality of pieces produced from these dies is due to the unique lubricating properties of the steel

(Continued on page 40)

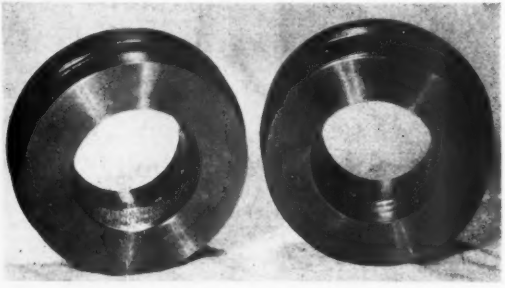

Fig. 7
The Steel Die on the Left Made 10,000 Pieces—Graphitic Steel Die on Right, 309,000 Pieces

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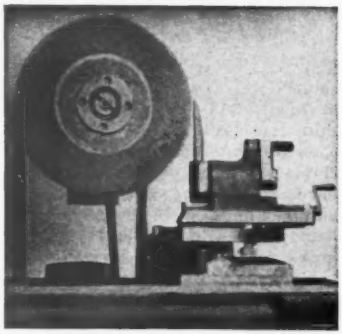

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"Nobility At Work"

We are indebted to the Industrial Bulletin of Arthur D. Little, Inc. of Cambridge, Massachusetts, for this interesting little article about the "noble" metals.—The Editor.

THE rise of platinum from $32 an ounce in June to $70 in September, 1936 followed by the return almost to the previous normal, has focussed attention on this interesting metal. Platinum is classed as rare, yet there is as much as seven to ten tons of the virgin metal produced annually in this country, in addition to reworked metal. The largest uses for it are in jewelry and dentistry, but no inconsiderable quantity also goes into chemical laboratory and even into plant equipment. The term platinum is occasionally rather freely applied to a whole group of metals including iridium, osmium, rhodium, and palladium, which, with gold, are collectively classed as the "noble" metals.

Nobility in metal means ability to resist the action of strong chemicals, particularly the mineral acids. It may also be expressed as lack of tendency to enter into chemical combination. Strong sulfuric, nitric and hydrochloric acids, for instance, may be heated for long periods in dishes made of noble metals, with but a minimum of attack. There is some attack in every case, however, so that nobility is not absolute, but may be expressed in degree.

Rhodium, being least attacked by most reagents, is the noblest of the noble, or the king of metals. Rhodium is also the brightest of all the non-tarnishing metals, having 80% of the reflecting power of silver. Its high reflectivity and its ability to stay bright after severe heating are utilized in the reflectors of huge military and civilian searchlights. It is also being plated over sterling silver to make it tarnish-proof, and a general jobbing service, called "rhodanizing," is now available in the larger cities, where jewelry, badges, etc., may be plated in small or large lots.

Platinum is the classical and still-useful material for crucibles and evaporation dishes in the laboratory. Appreciable quantities are also used in plant-sized equipment, both because of its specific reaction-inducing (catalytic) ability and its long useful life. It is standard, for instance, for the gauze in combustion chambers for oxidizing ammonia to nitric acid. In the aggregate, considerable amounts are used for the elements of thermo-couples, resistances, heater coils, and other electrical uses.

Platinum is hardened markedly when alloyed with about 10% of iridium, making it suitable to resist severe wear, as for furnace outlets for handling molten glass. No ordinary materials stand up in this service. Hardened platinum is also preferred for airplane ignition parts. Platinum alloyed with gold not only makes excellent points for fountain pens, but also stands the chemicals and wear remarkably well in the fine-bored spinnerets used for making rayon filaments. Where lightness is a factor, palladium may be preferred. While it is actually heavier than lead, it is far less dense than the metals of the group including platinum, osmium and iridium, yet is of good nobility.

The new technique of metal veneering, whereby two-ply metal may be rolled and shaped, allows the use of prefectly-secured noble metal linings, which produce vessels of almost interminable life for the processing of foods and chemicals. Kettles, tanks, and piping are now possible which have almost negligible maintenance cost, and which do not contaminate the product in any way.

With all the wealth of properties to be found among the noble metals and their alloys, and the economical methods now available for utilizing them to advantage, plant and apparatus designers no longer consider the use of rare metals as unthinkable for areas of severe service.

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New Disc-Brake Electric Motor

A NEW electric motor has been developed which is particularly adaptable for use with machine tools, small cranes, hoists and other equipment where quick, automatic and accurate stopping or the holding of a load are necessary. This new power unit is known as the "Disc-Brake" Motor, and it combines in a single unit the functions of a standard motor with those of a powerful brake. There are applications where it is possible to make a direct connection to the drive and thus avoid the need for a clutch.

The brake itself consists of a simple and compact disc-type friction device, mechanically and automatically engaged when the current is shut off and magnetically disengaged when current is applied. The friction lining is supported on a square steel hub which is keyed to the motor shaft. A "wear-indicator," combined with the manual brake release mechanism, gives warning whenever wear needs to be taken up. This setting, however, is separate from the torque adjustment, so that either may be adjusted independently. Varying braking power, from maximum to 50% of maximum, may thus be obtained as needed.

The "Disc-Brake" Motor is a product of the Reliance Electric & Engineering Co., 1080 Ivanhoe Road, Cleveland, Ohio, and it may be fitted to any standard Reliance Motor except those of the fan-cooled type.

All mounting dimensions conform to N. E. M. A. specifications so that standard brackets and bases may be used.

The brake cover, which is entirely separate from the mechanism itself, may be readily removed by loosening four cover screws, thus making all parts easily accessible.

The illustration is a "Disc-Brake" Motor of the Squirrel-Cage Type.

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Graphitic Steel

(Continued from page 36)

as well as to the fact that the dies and punches can be brought to the proper degree of hardness for the work at hand by simple heat treatments easily handled in any die shop.

Any graphite remaining in the graphitic pockets exposed in finishing a die functions as a natural lubricant of the highest grade. Further, these pockets continue to function as microscopic lubricant retainers, with the result that a graphitic steel die is always well lubricated. This oil retaining quality can be demonstrated easily by spinning an oiled piece of graphitic steel at high speed. Even after several minutes of spinning at 1800 RPM a graphitic steel bar or die will feel greasy, whereas other steels will be perfectly dry.

This lubricated hardness is apparently responsible for the freedom from scoring, pick-up or galling, which is so noticeable in the case of graphitic steel dies. This in turn enables dies to be kept in service longer before polishing or re-grinding. Experience in the Timken plant has been that polishing is reduced over 50% and that only about 20% as much time is required for re-grinding dies since graphitic steel replaced the other types of die steel formerly used.

With increased die life comes decreased overhead, due to the reduction in the number of spare or replacement dies which must be kept in stock. Timken experience has been that the spare die stock for production dies can safely be reduced to 25-30% of the number formerly carried on hand. In the case of small dies this may not seem to represent a heavy investment. In the case of a single size this may be true, but when that saving is multiplied by the whole range of dies required in a large plant it becomes an important item at the end of a year. A substantial reduction in the cost of die stock is attained, for graphitic steels are comparable in price with ordinary die steels. However, it is

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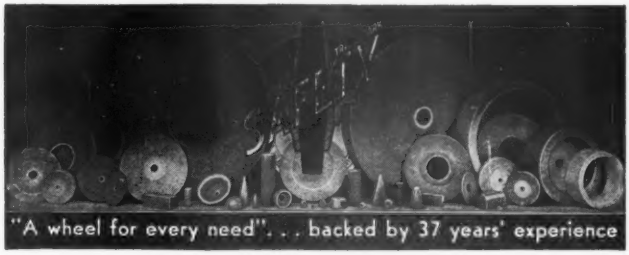
the saving in labor and machine time expended on die and punch manufacture that mounts up so rapidly.

Still another important economy has been found since changing die steels in the Timken bearing factory. That is in the saving in press production time. Experience shows that a press is down at least 45 minutes on an average whenever a die or punch must be changed for any reason. If the shut-down is due to a change in the production schedule, there is no advantage in one steel over another. However, where schedules permit long runs, as is customary in modern production practice, any shut-down due to die wear or failure is directly chargeable to the die. Consequently, when experience shows that a graphitic die lasts 10 times as long in production as did a former die, a saving of approximately 8 hours in production time is made. In other words, at least, 40,000 more pieces can be produced on a press using a graphitic steel die than can be made on the same press in the same length of time when using such former die.

Thus the savings made possible by graphitic steel in production work through reduced die manufacturing costs, reduced stock and overhead, reductions in set-up expense, and increased production due to the increase in available press operating time, are substantial. With these savings also come the more intangible item of improvement in the finished product, and a decrease in the number of spoiled or rejected pieces. In work where appearance is important this is essential, and where a uniform, smooth surface is structurally necessary, as is the case in bearing cages, this factor becomes vital.

Much work still remains to be done in the development and application of graphitic steel and research and experimental work in production operations is being continued. The indications are that a wide range of applications exist where these new steels may prove valuable, but it should not be thought that every problem in the die industry can be solved by using graphitic steel. Its value in the die field, however, is apparently well established.



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A New Universal Die Making Machine Described by the Inventor, F. W. Hack

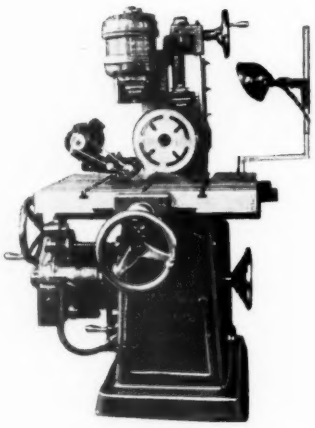
DIE making is essentially a succession of operations, each occupying time and effort. Much of the time is consumed setting up the various machines required. Frequently, although the operation must be exceedingly accurate, very little is done on one machine before it becomes necessary to transfer a workpiece to another and thence perhaps to the bench for handwork. If this inevitable setting up and tearing down of one machine after another can be avoided, there should result a considerable saving of time.

The Hack Universal Die Making Machine recently developed incorporates in one machine the principles of operation of several others. After testing for a year and a half on actual work a modern machine was built and it was demonstrated that a complete die could be built on a single machine with the greatest degree of accuracy and speed.

The outstanding purposes of this Universal Die Making Machine are to reduce die shop floor space and eliminate nonproductive effort which include changing from one machine to another, along with the detail of preparation which goes with such changes. The Universal Die Making Machine requires a space about 4 feet square.

To accomplish the objective it was necessary to evolve a machine having two distinct kinds of cutting properties, heavy and sensitive duty, and also to combine in one machine a reciprocating as well as a rotary motion. The next important requirement was that a maximum number of operations could be performed with a minimum number of attachments and that the machine be so designed as to make it unnecessary to lift heavy attachments. Another requirement was that changes from one class of machining to another would take less time than needed to go to a nearby machine capable of doing the class of work desired.

In the development of the machine it was recognized that a job once set up should not be removed until all related operations were performed. Thus it was desirable that a die block once set up



should be scribed with the scribing tool head in connection with the Vernier attachments to assure accurate boundary lines and centers. The removal of the scribing head is but a moment's work. The vertical head is quickly substituted and thus the jig boring of all holes in true relation to the boundary lines is easily accomplished. The vertical head is then removed and the slotting attachment fitted into place, the core of the die being thus sawed out or slotted as desired. Rough filing follows with this same attachment, the screw feed being used until the opening is of correct size. Still using this same high speed slotting attachment, the clearance is filed all around. Screw holes and reamed holes are drilled at the same time as the jig boring is done. Combining the stripper plates and punch plates with the die blocks save much time. Many short cuts are possible, for instance, with the use of the rapid cutting hack saw attachment excess material is cut away, reducing the finishing of such sections to a power filing operation instead of the customary shaper or milling set up.

The Universal Die Making Machine, stripped of all removable units, consists of a base, a spacious compound table, a reciprocating rear ram, adjustable for

(Continued on page 44)

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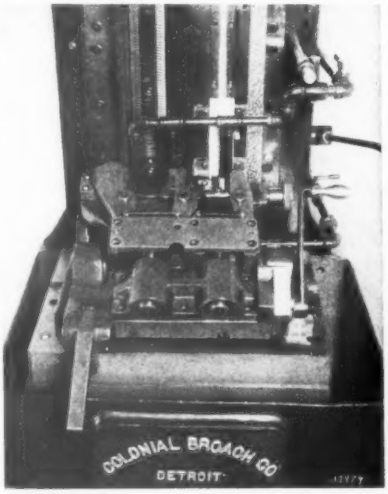
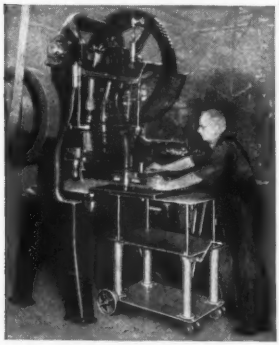
The yokes, or forks, are steel forgings and the operation is complete from the rough forging to the finished with a single pass of the broaches. This is accomplished by the left hand broaches operating on the inside faces of the forks while those on the right hand cut the cross-slot in the fork and also finish the end face of the shifter yoke.

The production rating of this machine is 300 operations per hour. The time required for loading both fixtures and returning the ram is 10 seconds, while the fixtures and cutting stroke are positioned in 8 seconds. The machine is rated as of 10-ton capacity with an overall stroke of 36 inches and a cutting stroke of 32 inches.

Only the fixture is operated manually through the control lever shown in the illustration, otherwise the machine operation is entirely hydraulic, the fixtures being positioned automatically.

More detailed information regarding this and other types of Broaching Machines may be had by addressing Department TD, Colonial Broach Company, 145 Jos. Campau Street, Detroit, Michigan.





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Universal Die Making Machine

(Continued from page 42)

stroke or position and lockable in a stationary position if desired. To this ram is fitted a screw elevated master head to which other attachments are fastened. Incorporated in the master head is a back-geared milling spindle of liberal dimensions and vertically adjustable within the ram. This embraces all the functions of a horizontal milling machine. This head also serves as a lathe spindle.

Next in importance to this master head is the vertical head which one man easily holds in one arm. Attaching this head is a simple matter of a few minutes. Rigidity is not sacrificed because of lightness, compact design covers that point.

This vertical head is rotatable throughout a circle. In the vertical position it has 8 speeds, four back geared and four high speed. When used in an angular position it has 4 speeds, all back geared. Associated with this spindle, but removable from it, is the high speed sensitive slotting head, also used for filing, lapping and other reciprocating operations. Its function is to provide slotting facilities for small openings, then filing and later, after hardening, lapping the opening. It is universal and can function at any angle. It has 8 speeds, four back geared and four open belt. This attachment may also be used independently of the vertical spindle and, with the aid of an adapter, be fitted to the master head.

A hack sawing frame, instantly attachable to the master head, holds standard blades 8, 10 and 12 inches long. It is used in connection with an elevated table used interchangeably with the removable center plate in the table top. Screw feed may be used behind the cut if desired; provision for clamping is provided.

Drilling of large holes is accomplished with the vertical spindle operated in back gear. A 10-inch face plate fits the master head spindle, as does a 6-inch, three or four jaw chuck. Stud turning, boring and facing are thus accomplished in combination with a compound slide. Bore grinding of round dies, or even irregular

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openings is accomplished in the same way.

The reciprocating rear ram has a stroke adjustment of from ½ to 3½" and speed of 90 strokes per minute. When driving slotting or vertical shaping tools, heavy cuts are made possible. Electrical equipment consists of a 3 H.P., 60 cycle, 220 volt, 3 phase motor which drives the ram, and a ¾ H.P., 60 cycle, 220 volt, 3 phase motor for the master head, providing ample power for severe service. Fifteen different kinds of cutting operations are done with regular equipment, and these can be doubled with auxiliary adapters.

A standard grinding attachment used with a simple adapter is used both vertically and horizontally. Thus surface, bore, cylindrical tool and cutter grinding are done. Either plug, ring or snap gauge grinding is easily accomplished.

Among the reasons why this new type of Universal Die Making Machine should reduce die making costs are:

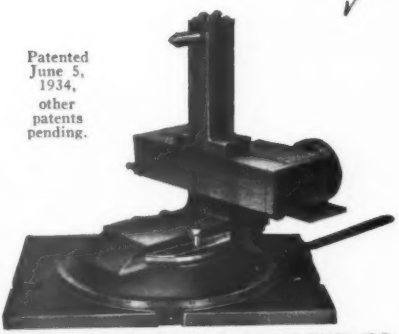
Confinement of the operator to a close area around a space four feet square.

Confinement of all material within the same area, eliminating the necessity for conveying die parts from machine to machine.

Only one set of clamping equipment is needed as compared with several where different machines are used.

Time required for setting up jobs accurately on one machine after another is eliminated.

Patented June 5, 1934, other patents pending.



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Business in Europe

(Continued from page 12)

which is causing many desperate struggles for substitutes. Of the 60 million German people, it may be said that they are peace-loving, industrious, and the most hospitable people in Europe. Their manufacturing plants are clean, beehives of efficiency. They are lined up behind Hitler in a blind faith, resulting from thought control, believing that armed peace and Hitler's policies are justifiable and infallible.

Italy has a greater embargo on money than Germany has. Money is simply not allowed to go out of Italy to buy foreign products, not even to fill the crying need of replacing its backward tool rooms. Since only three per cent of Italy's 53 million people are engaged in mechanical industries, the lack of Italian buying power is not of much importance to the American manufacturers. However, this lack of purchasing power and scarcity of machine tools in Italy are factors of great importance from another standpoint. These factors contribute toward the unlikeliness of any general European war for quite a long time in the future.

Czechoslovakia has become a thriving republic in the brief twenty years of its existence It has its own vast land and air defense force. It has built a government subsidized machine tool industry. Striking examples of the most advanced machine tool styling and design were apparent among their lathes exhibited at the annual fair this year at Prague. Next to England, Czechoslovakian industries and the Czechoslovakian Government were most interested in improving their methods and DOALL machines were quickly purchased by the Government Arsenal and progressive industries in that country.

Military authorities believe this country will be the main battle ground of a "next war." It is hemmed in between Poland, Austria, Germany and Russia, and the country is war conscious to the extent of building up the newest and best in defense equipment.

Russia's 150 million population march forward with an industrialization program that may one day give us much world competition in the manufacture of capital goods. An interesting plan for the introduction of the newest and latest machine tools is their permanent machine tool exhibition at Moscow. Here, the Russian buying agencies have assembled all of the world's very best machine tools. These are demonstrated by expert Russian operators. The DOALL at this exposition attracts a constant crowd.

France is neither prosperous nor in a healthy condition politically. Communism continues to occupy the imagination of many French workers. The shaken confidence throughout industry that results has retarded a balanced expansion. France has practically no machine tool industry of its own, and its plants are equipped with American makes of machine tools, in the majority.

The little European war in Spain will, no doubt, continue for several more months. It now appears that Franco will turn it into a Fascist state, and that the crisis, provoking a general European war, is definitely past.

The charming Scandinavian countries are the most prosperous of all. They are not shackled with war preparations and they do not complain about lack of raw materials, and can buy what the need. It is a refreshing relief to see prosperity without militarism. One more refreshing place in Europe reflects the prosperity of the whole continent, and that is Antwerp. At this "free port," where imported goods are landed and stored without duty for reconsignment to various inland buyers, one sees real symbols of prosperity. Here on Antwerp's miles of warehouse docks, there are endless stacks of baled cotton, timber, cases of American machinery, and cases containing hundreds of the three makes of leading imported cars, i.e., Hudsons, Chryslers, and Packards.

In spite of the current race for self-sufficiency, it appears that a balance of power has been reached in Europe, that the possibility of a general war is remote, and prosperity will continue for at least some time to come.

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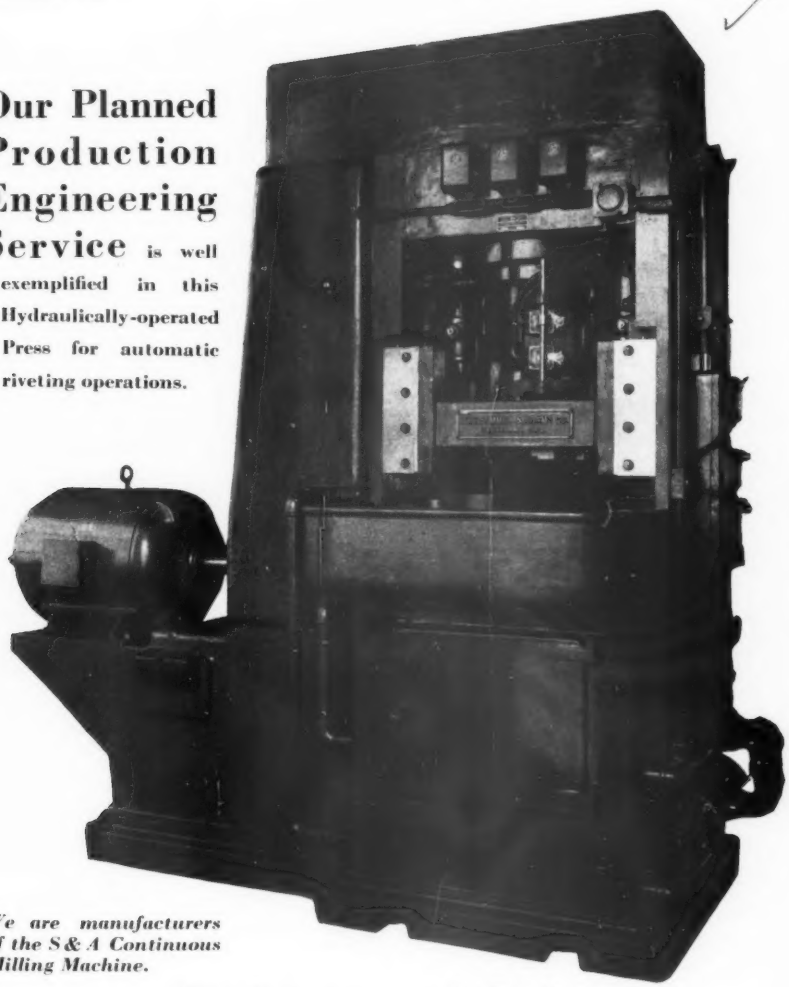

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